E-HEALTH

THE FUTURE SERVICE MODEL FOR HOME AND COMMUNITY HEALTH CARE

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1. Introduction

The delivery of health services around the world is changing rapidly, brought about by advances in surgical and non-surgical treatments, the increasing aged population, funding pressures, and the increased availability of self-help facilities and private health care schemes.   Less time is being spent in hospitals through advances in surgery recovery times, pressures on beds, the availability of better home help services, etc. This all requires a new model of the delivery of health services provided in the home or in the community, ie not primary or secondary services provided in hospitals and doctors' surgeries.

For the purposes of this document it is necessary to differentiate between what is commonly called primary and secondary care, and home and community care. Primary care refers to the work of health care professionals who act as a first point of consultation for all patients within a health care system, and secondary care is the health care services provided by medical specialists and other health professionals who generally do not have first contact with patients. Home and community care refers to the many types of health care interventions delivered outside of these primary and secondary facilities. It includes the services of professionals in residential and community settings in support of self care, home care, long-term care, assisted living, and treatment for substance use disorders and other types of health and social care services.

This document focuses on the latter category and describes how these future home and community services can be delivered using new technologies using standards developed by the EPR-forum and OASIS, and provides an overview of current efforts to build a new demonstrator showing how these services can be provided by the interoperability of the various devices and systems.

2. The Future Service Model

Advances in technology are providing the devices and means of delivering necessary health services to locations away from hospitals and surgeries, eg to patients' homes, care homes, holiday homes, etc. Through the use of these various devices and also online self-help facilities patients can service their own needs but at the same time trigger emergency help when the need arises. Annex 1 illustrates how the various e-devices can be used within the home and Annex 2 shows some of the devices that are available today.

Use of these technologies and devices does not take away the need for face-to-face interaction but they do enable that time commitment can be kept to a minimum and thus reduce the burdens on the already over-stretched health care resources. It also enables the desire of many patients today, especially the elderly, to be independent and remain in their own homes rather than being kept in hospital or in care homes. Examples of the advances being made are as follows:

− doctors in USA have developed a number of apps that can run on a smart phone providing remote, wireless diagnosis and monitoring that can lead to better and cheaper healthcare and provide lifestyle changes for the patient . They are also developing a remote wireless monitor that can be worn on the wrist to reduce the need for constant visits to a hospital or surgery. More information about this is available at http://video.msnbc.msn.com/rock-center/50582822#50582822.

− researchers at the Technical University of Munich (TUM), in collaboration with business partners, have designed an assistive system for helping senior citizens live at home by embedding a tablet computer in the wall. As well as providing a central location where users can access all of the information they need, such as family and emergency phone numbers, it also contains biosensors that can measure vital signs so the system can recommend exercise or medication, or alert a physician or mobile nursing service if the health problem is critical. More information about this is available at http://www.tum.de/en/about-tum/news/press-releases/short/article/30440/

Whilst the technology exists today as these examples demonstrate, there is a need to ensure that all the various devices can work together and provide a single view of the patient's care needs. That is where the use of standards comes in and it requires hardware and software providers to use these standards to ensure there is the necessary interoperability that enables the required flows of data between patients and healthcare practitioners.

In addition to making the various devices work together, huge benefits can be achieved with a single system of data entry - as more and more people are being discharged from hospitals sooner, with more focus on management in the community, having that vital information about what has been happening in either sector provides a more effective prompt service to the patient. Much time is wasted in hospital in trying to find out what has been happening in the community before admission, and vica-versa, so if this information is readily available, more productive time could be spent ensuring the patient got the required treatment. And it would promote better multi-disciplinary working if all health professional notes were shared, because each professional's work is affected by another's'. Linking these various records would be valuable to monitor those patients who are at risk of self neglect/isolation in the community

3. Implementing the new Service Model

There are a number of aspects that need to be addressed in order to implement the new service model for home and community health care. These are described in the following sub-sections.

3.1. National Transformational Infrastructures

Dealing with global Internet information exchanges on a large number of different world based connected national infrastructures requires the need to split the global governance of the physical infrastructures and the private and public controlled services running on them. Cloud technology should not exclusively be controlled by private business enterprises; they need to co-operate with the **Public Supervision & Quality Assurance**(PSQA) based Public cloud services. Cloud services should show a clear split between the data and the software solutions. The data should be preserved for "ever" but the software needs to be substituted and changed according to the technology development. Today several national governments are wasting enormous amounts of money on infrastructures run on private software vendor's regimes. Adaptive and agile templating requires a clear split between shared data and the different interacting software applications.

Ineffective and inefficient progress can be seen by example in Norway where taxpayers' money is being wasted building unneeded isolated public networks with tied up services not available for the citizens or other application business areas such as:

- Health care networks
- Smart Grid networks
- Police networks
- Military networks
- Emergency networks
- Broadcasting networks
- Tax system networks
- Road and Railroad control networks
- etc

New thinking is required to differentiate between the following 5 important related aspects:

1. **National communication infrastructures** - "Information Highways" the national physical interacting packet switched IP-networks using basically Fibre and 4G-mobile networks.
2. S**hared Data** - shared persistent data in public registers.
3. **Abstract Common and Open Service Models handling Information Exchange** - downward semantic compatibility interacting on the shared data.
4. **Traditional Software programs/platforms** - the software should be adapted and substituted continuously according to new applications, legislations, technology and methodologies. All information exchange should be done through common certificated Service Models.
5. **Executing legislated public services** - done by both private and public enterprises.

Today's typical mix of these 5 areas into silo and monopolistic systems of locked vendor regimes do prevent the needed interaction reforms in public sector to succeed, especially regarding the legislated public services needing a common national interaction area indicated by 1, 2 and 3 above. This has to do with society's backbone responsibility of administrations tasks, not driven by profit

goals, but operating securely and enabling fair competition in areas 4 and 5 above for business related software and attached services. Even if areas 1-3 are the public sector's responsibility, companies should be able to compete on common terms to handle them, but these companies should be prevented from delivering software programs/platforms or services to avoid a monopolistic or oligopolistic market situation.

3.2. Service Management

The physical implementation of this new service model will be by using the Internet to enable the standardized flow of data between patients and the executers of health care services. Most of this data comes directly from the patient's own monitoring e-devices but also via self-help facilities. Through a neutral and public defined "Super Structure" it is possible to demonstrate how to solve much of the rising health care interaction problems related to the holistic approach of needed common information exchange modelling. The interaction via the Internet enables new ways of self diagnose, self service and use of expertise through new ways of frontline services management predicted through the OASIS Transformational Government Framework.

This new way of agile META engineering is based on the EPR Public Supervision and Quality Assurance program (PSQA) which is developing a common electronic framework for the healthcare supervision and quality assurance of citizen services and for the business enterprises involved.

PSQA is intended to be used in all relevant health care supervisions and by the enterprises that need to comply with the supervision requirements. It is based on international quality standards and uses electronic folders that integrate and interact with the underlying legacy and expert systems in general handling the service management.

An important aspect is the interaction between the workflow service management for service executers dealing with the **EPR-eFolder standard** and the condition monitoring and deviation response system handled by the **EPR-eDevice standard** in real-time, home automation and body sensing condition monitoring. Typical application areas are:
- Integrated eDevice Condition monitoring (Body and Environment adapted User Scenarios)
- Interaction of eFolder Service work, Planning and Reporting (Task description, reporting and inspection)
- Service Tool access CAM Templating editor (Role control by Digital signature as OASIS PKI)

Further information about PSQA and the use of EPR standards to provide healthcare service management is available at http://www.eprforum.no/product.php/Supervision-and-Quality-in-Home-care-services/50/

3.3. The EPR-eFolder Standard

The solution to delivering the service management described above is to extract the computer support into electronic folders. The folders have a standard design with standardized functionality and give the user access to all needed information and help in the performance of the task. Access is given through "single sign on" and approved digital signatures for identification. Special applications and expert systems can be integrated into the folders. A draft for a general functional standard in

order to structure and organize the content in the folders has been developed and is available at http://www.eprforum.no/product.php/Standard-EPR-and-e-Folder/3/ .

Important properties of the e-folders are:

- The folders are a framework. The framework has several purposes, a common access point for all relevant information, in order to integrate under laying systems, to be used as next generation of "front Office". The framework will function by use of open standards for processing XML-based templates. The folders will also be able to use a number of other standards.
- Integration of applications and data will be controlled by commands (on demand). Applications can be components in special applications, expert systems, help for users e.g. Access on command is the opposite to permanent access. Access on command belongs to a technology called loosely coupled applications.
- The folders are customized (adapted) for the actual need. This means that only correct and needed information will be available through the folders.
- The folders are dynamic; they can be extended or reduced as needed. This is possible because of the standardized structure that the folders have been designed around. The structure is the base for «automatic» modeling of generic information.

The principles around customized folders and access on command are important components in order to avoid unnecessary dispersion of information. In addition to clear role structure this is especially important in order to protect sensitive information and to protect personal integrity.

Further explanation of the e-Folder Standard is available at http://www.eprforum.no/description.php/EPR-eFolder/6/ .

3.4. The EPR-eDevice Standard

The EPR eDevice standard sets down the Methodology for Condition Monitoring and the environmental access control template management. It represents a standardized functional mirrored model of electronic network devices (nodes) that are connected to e-Folder content through Web services technology. It is derived from the ANSI/CEA-721 work developed over the last 25 years by more than 400 companies, organizations and individuals. It is important to note that CEA has transferred CEA-721 and CEA-844 to the EPR Forum.

Environmental control and patient condition monitoring through interoperating electronic equipment is crucial for self centric health care management. The standard demonstrates how all the real open BUS-technology standards can interact through a common top level real open XML based functional modelling layer.

Tools and modelling dictionaries are specified by using the OASIS CAM and BCM standards and are available through the EPR-forum. The forum is now able to provide template modelling deliverables by means of the EPR-forum executive team continuing the standardization work in the OASIS BCM-EPR TC as the **EPR device functional standard.**

Further explanation of the e-Device Standard is available at http://www.eprforum.no/description.php/EPR-eDevice/5/ .

3.5. Demonstrator

The EPR Forum is currently able to demonstrate an application for care flats in Drammen, Norway. This has been developed in conjunction with the HiBu Research laboratory at the Buskerud University College.   The next step in this project is to compose a number of scenarios with the help of health care practitioners showing how the various facilities provided within the care flats can be used. The Forum would welcome the participation of any organisation or individual, either from the private or public sector, who has an interest in the further development of this project. Please contact Hans A. Kielland Aanesen at hans@eprforum.no for further details.
See "CAM Open Data Tool and Examples" : http://tGov.no/cam-open-data-tool-examples

4. Using the OASIS standards

Many of the standards required to support the delivery of the services described above have been developed by OASIS (Organization for the Advancement of Structured Information Standards – see www.oasis-open.org), a not-for-profit consortium that drives the development, convergence and adoption of open standards for the global information society. Most standards produced by OASIS are universal standards that support a whole range of e-business initiatives running across the Internet, but the three described below provide the means of defining and developing the specific model for the home and community service care.

4.1. Transformational Government Framework (TGF)

Transformational Government is a managed process of ICT-enabled change in the public sector, that puts the needs of citizens and businesses at the heart of that process and which achieves significant and transformational impacts on the efficiency and effectiveness of government. The TGF sets out a whole range of standards, methodologies, policies, strategies and the like that are required to implement the Transformation Government approach. The most relevant characteristics of the TGF approach that support this new care service model are:

- it takes a whole-of-government view of the relationship between the public sector and the citizen. This provides the correct working environment for the new model to be developed through the use of joined-up resources across agencies, the sharing of data, the use of common rules and procedures, etc.
- it recognises the need to e-enable the whole frontline of public services: that is, including staff and organisations involved in direct, personal delivery of services (such as healthcare) as well as e-enabling transaction-based services.

Using the TGF approach will ensure an effective programme of change can be developed to deliver the services for the new home and community care model. It will ensure that all the necessary stakeholders are involved, that resources are correctly identified and managed, and that the envisaged benefits and outcomes are achieved.

4.2. Business-Centric Methodology (BCM)

The Business-Centric Methodology is a specification that provides business managers with a set of clearly defined methods with which to acquire agile and interoperable e-business information systems within communities of interests. It provides managers with a clear understanding of what the business goals and appropriate steps are that need to be applied for a specific project to succeed.

The BCM efforts are on communication at three levels: (1) lexical, (2) semantic, and (3) pragmatic interoperability for sets of Community of Interest (CoI), eg health care. The BCM templates collect objectives and rationale for pragmatic interoperability by recording and sharing design decisions along with artefact data. The layered BCM products relate one or more artefacts together by including rich metadata on each link for semantic interoperability. The BCM combines together these components and calls for their management within an information architecture founded on conceptual agreements (lexical).

4.3. Content Assembly Mechanism (CAM)

The Content Assembly Mechanism provides a generalized assembly mechanism using templates of business transaction content and the associated rules. Information exchanges are moving to technical formats using XML technology worldwide. However XML by itself is only a mark-up language, it was never intended to support exacting business interchange definitions, rules and industry vocabularies. To provide that extra level of robust information definition and exact control CAM has been developed to enable business users to quickly and easily use templates to declaratively assert these missing business rules and structural information requirements.
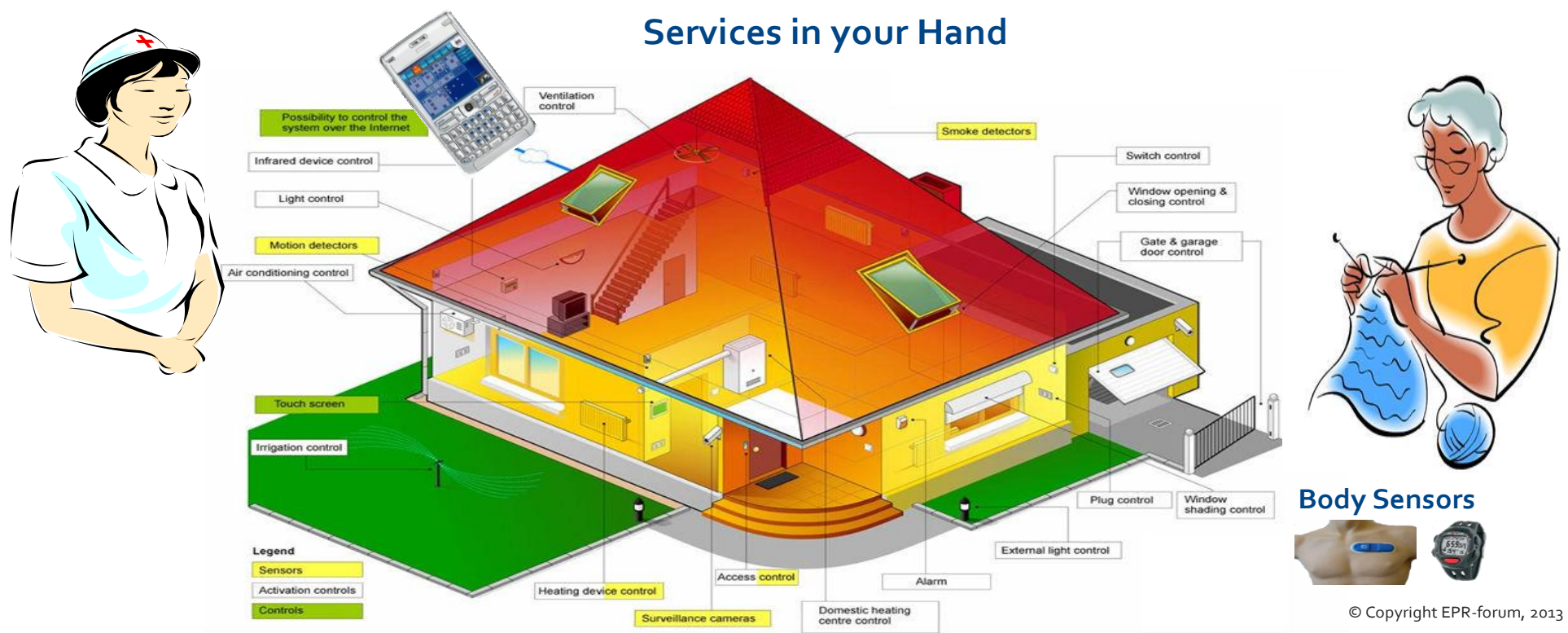
Examples using the CAM editor have been developed to make the necessary template models for 3 eDevice health units, a SmartGrid Light sensor, a Thermostat and an Electrical meter, and these are now available on the EPR-forum website. *http://www.eprforum.no/product.php/CAM-Template-EditorProcessor/37/*

5. Summary

The delivery of health care services is changing rapidly across all aspects of primary, secondary, home and community health care. New treatments, advances in technology, new working practices and promoting patient choice are causing a fundamental re-think of traditional patient care. The provision of devices and the means of delivering necessary health services and persistent data to locations away from hospitals and surgeries, ie to patients' homes, care homes, holiday homes, is not still a futuristic dream. A significant amount is available today and further facilities are being brought to market on a regular basis. However the key to the successful use of all these facilities is the need to make the devices interoperate and provide a single view of the patient's data to health care practitioners so that the correct treatment can be provided. Through the use of various standards developed by OASIS and implemented by the EPR-forum this is now possible as has been outlined in this document.   Work is proceeding on building a real-world demonstrator and all stakeholders are invited to get involved to help build the best health service for future generations.

The EPR-eDevice Standard ©
(A standard handled by OASIS BCM-EPR SC and EPR-forum)

Services in your Hand

Possibility to control the system over the Internet

Infrared device control

Light control

Motion detectors

Air conditioning control

Ventilation control

Smoke detectors

Switch control

Window opening & closing control

Gate & garage door control

Touch screen

Irrigation control

Legend
Sensors
Activation controls
Controls

Heating device control

Access control

Surveillance cameras

Alarm

Domestic heating centre control

Plug control

Window shading control

External light control

Body Sensors

Annex 2 – Home Network Devices